

1/25

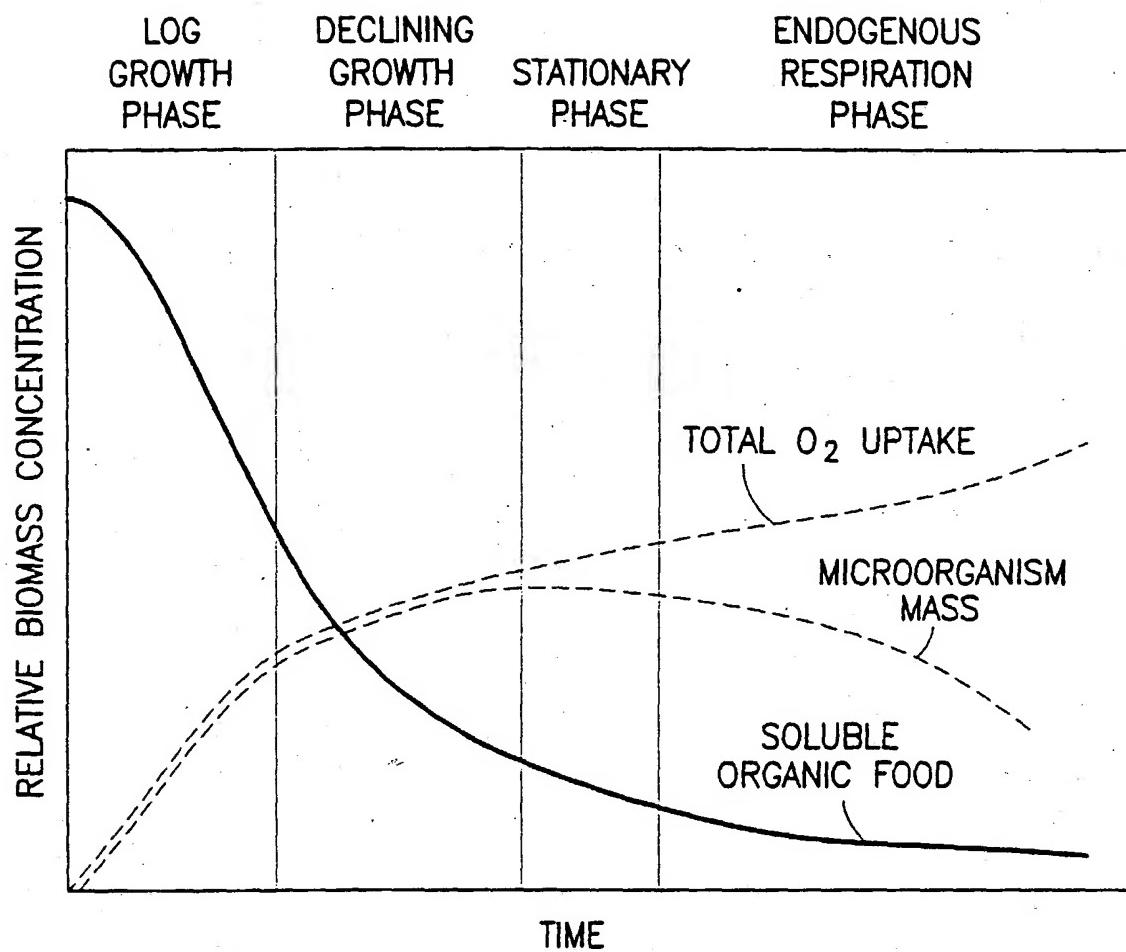


FIG.1

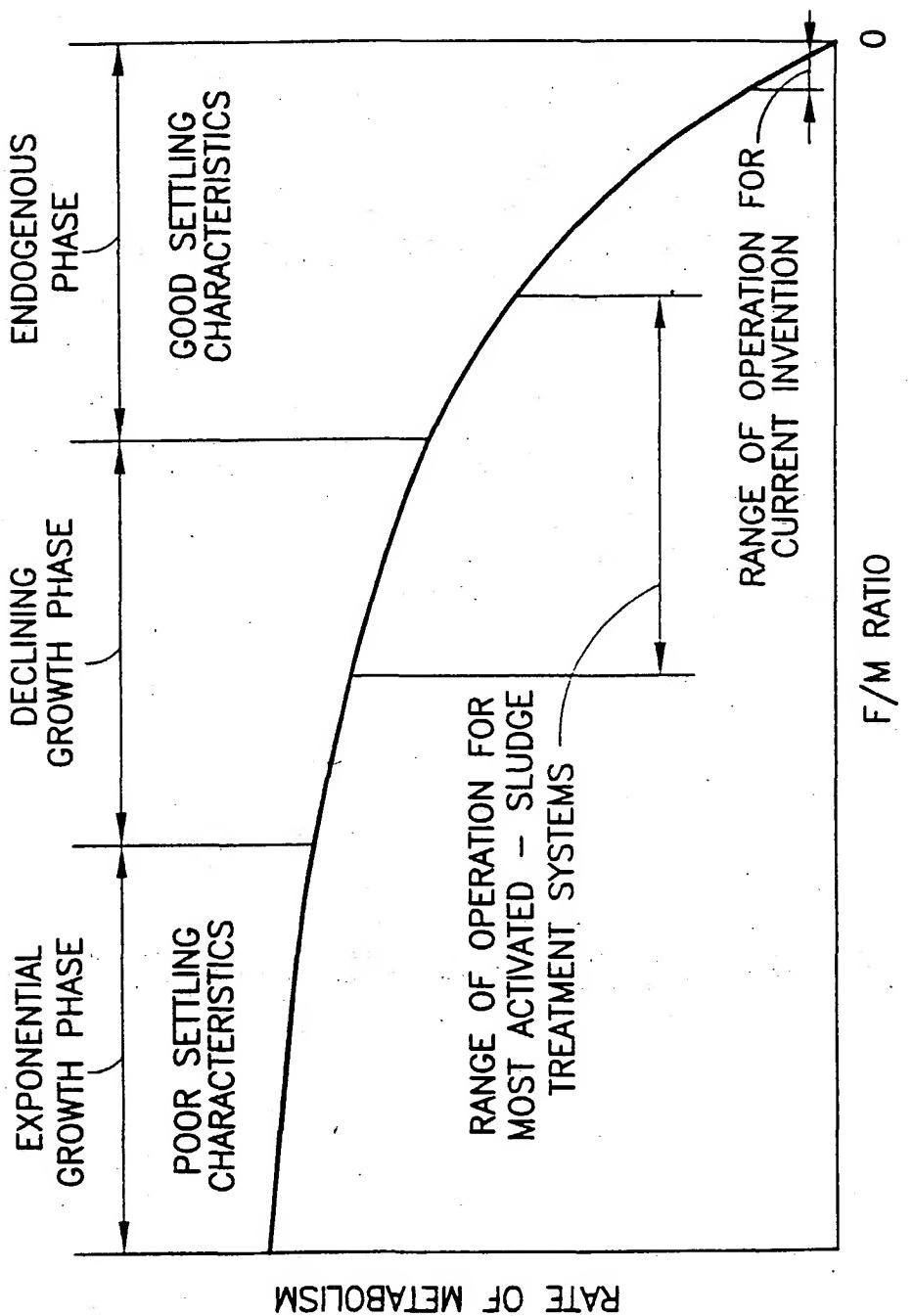


FIG.2

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	PRESENT INVENTION	COMPLETE MIX	PLUG FLOW	CONTACT STABILIZATION	STEP FEED	EXTENDED AERATION
AERATION TIME (hrs)	4-8	3-5	4-8	.5-1.0	3-5	18-36
MCRT (days)	30->150	15-30	15-30	5-15	5-15	15-30
F/M RATIO (lbs BOD/day/lb MLVSS)	0.05-0.80	0.05-0.20	0.05-0.20	0.20-0.40	0.20-0.4	0.05-0.2
MLSS	2,000-10,000	3,000-6,000	1,500-3,000	1,000-3,000	2,000-3,500	3,000-6,000
RAS RECIRCULATION % RAS/(Q)	25-100	25-100	25-50	25-100	25-75	75-150
PROCESSING RECIRCULATION %	500-2000	N/A	N/A	N/A	N/A	N/A

WASTEWATER TREATMENT SYSTEMS COMPARATIVE

**FIG. 3**

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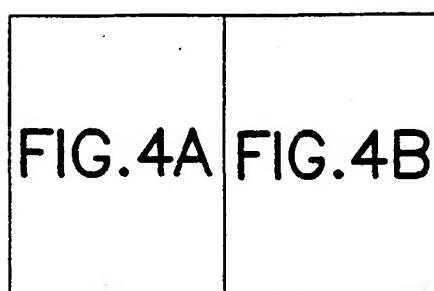
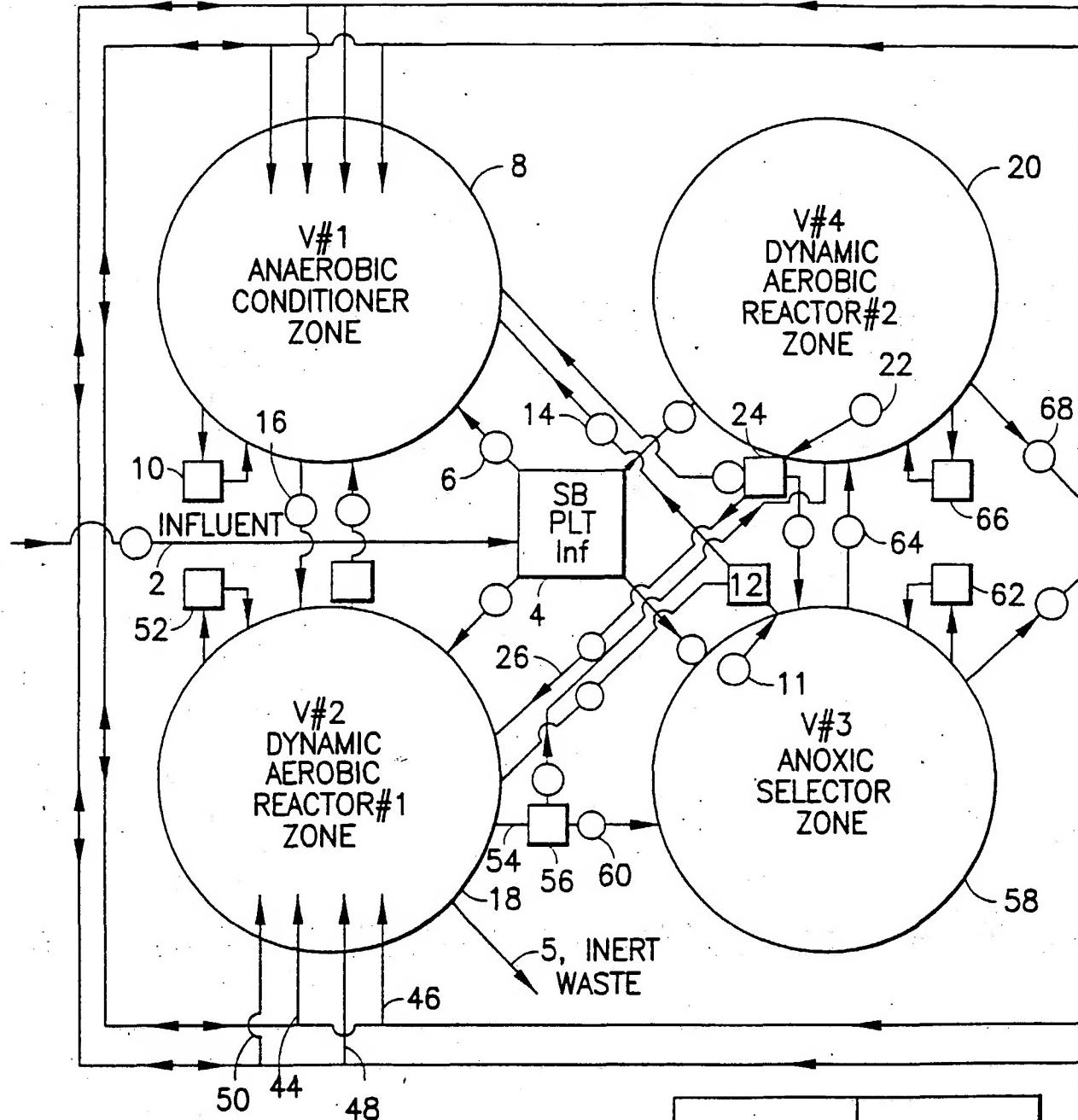


FIG.4

FIG.4A

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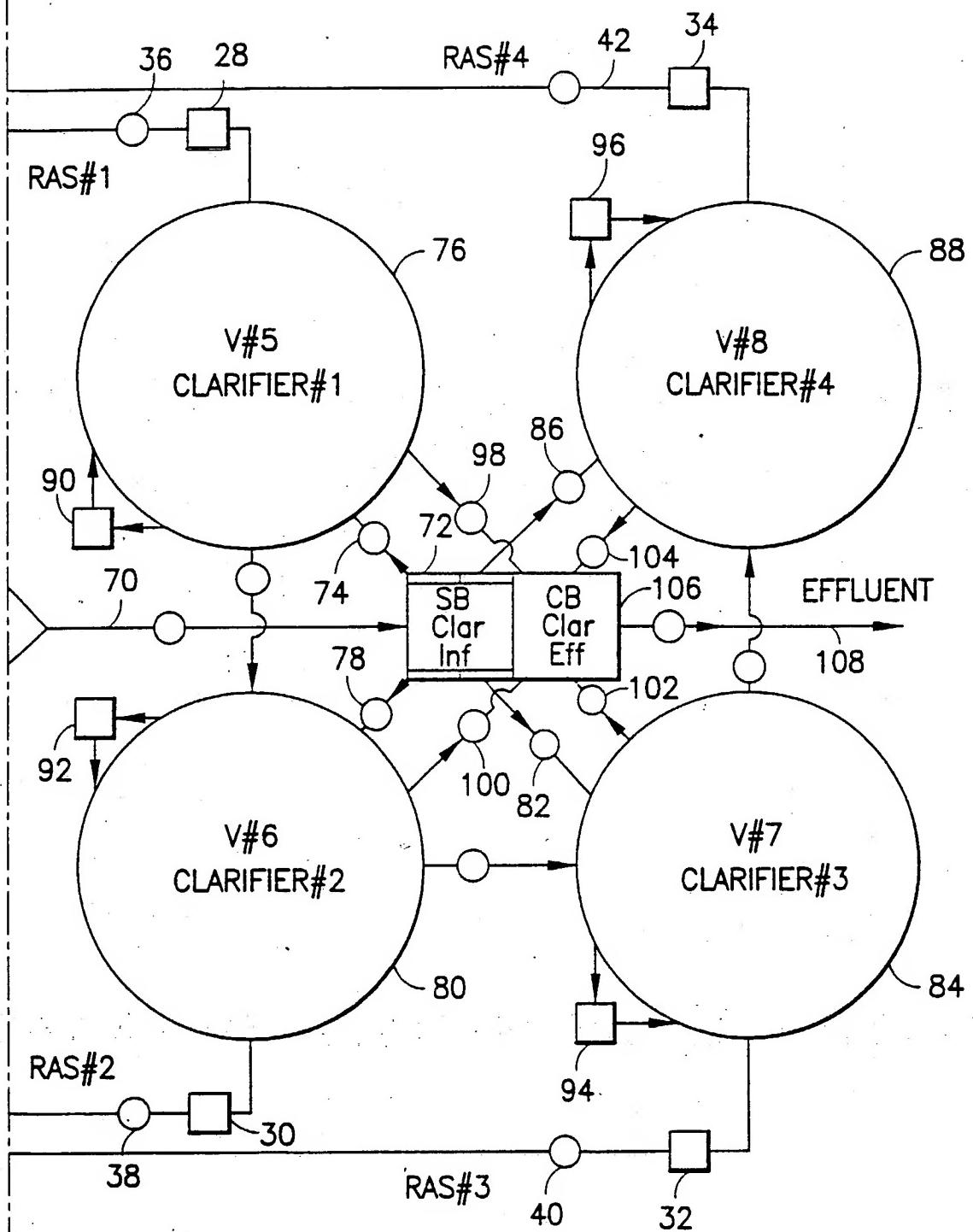


FIG.4B

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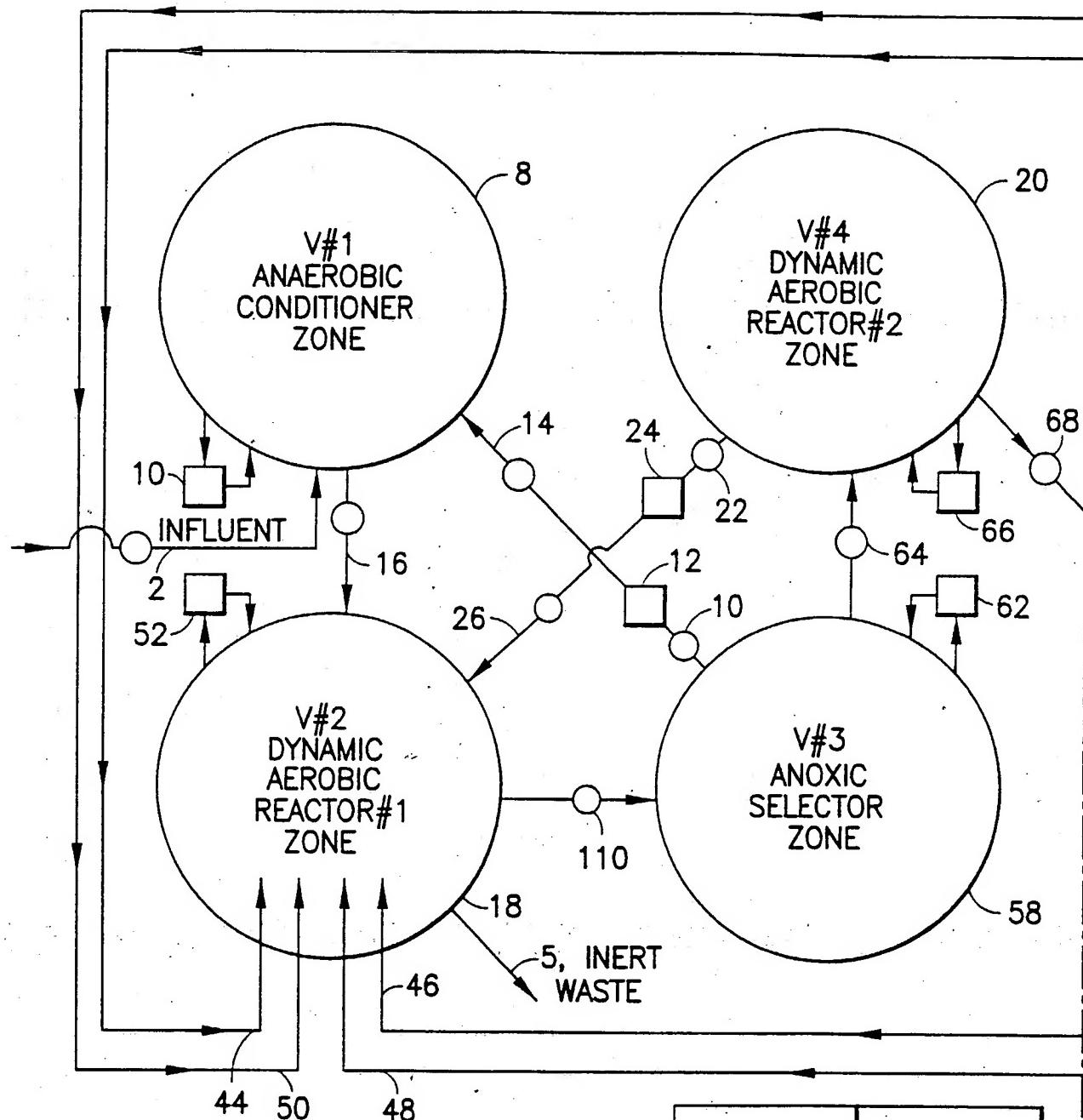


FIG.5A FIG.5B

FIG.5A

FIG.5

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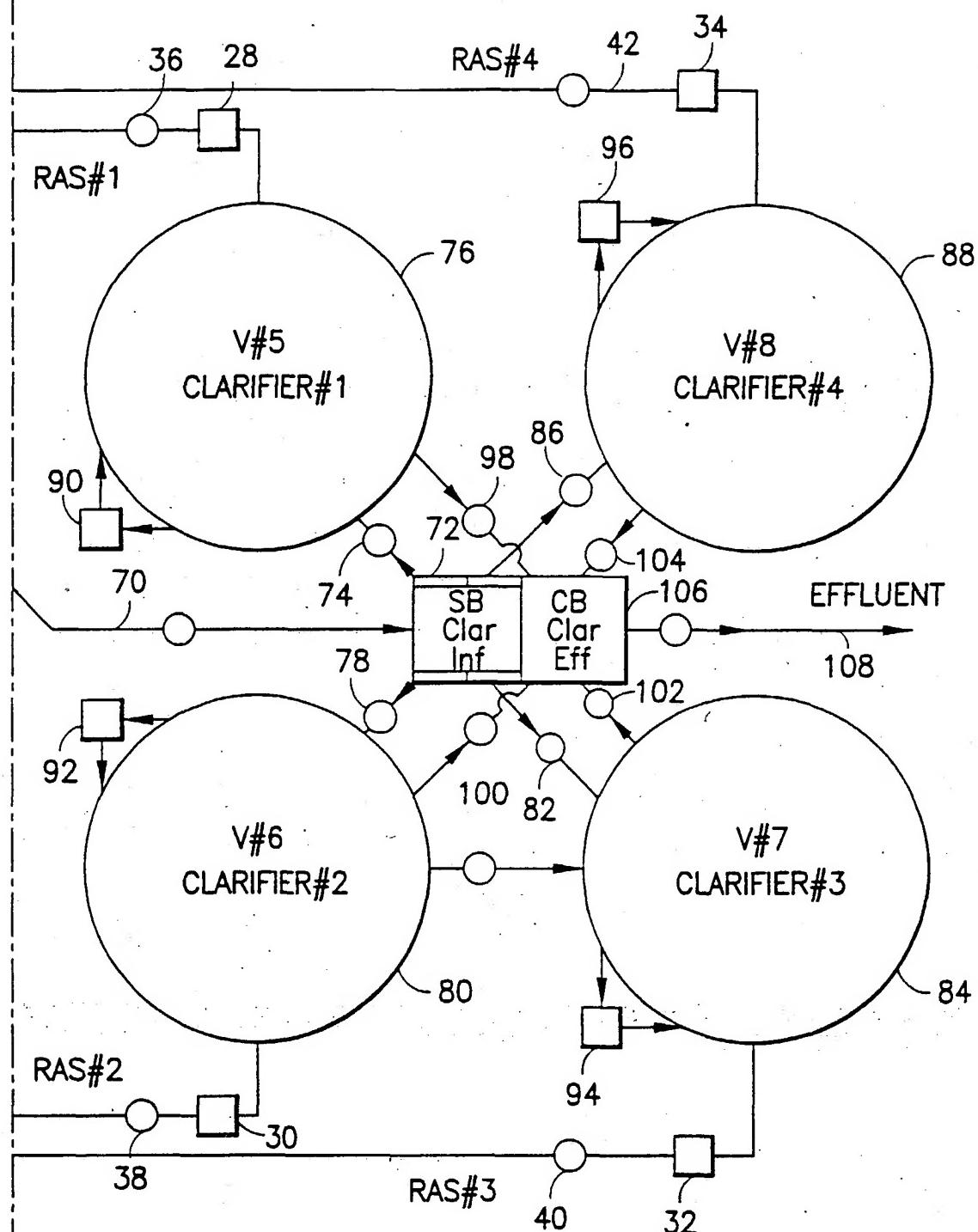


FIG.5B

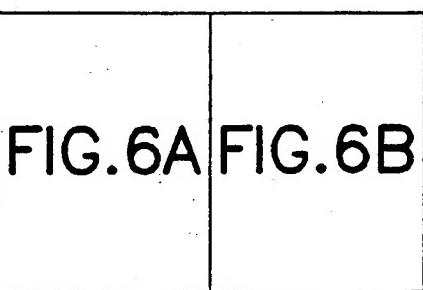
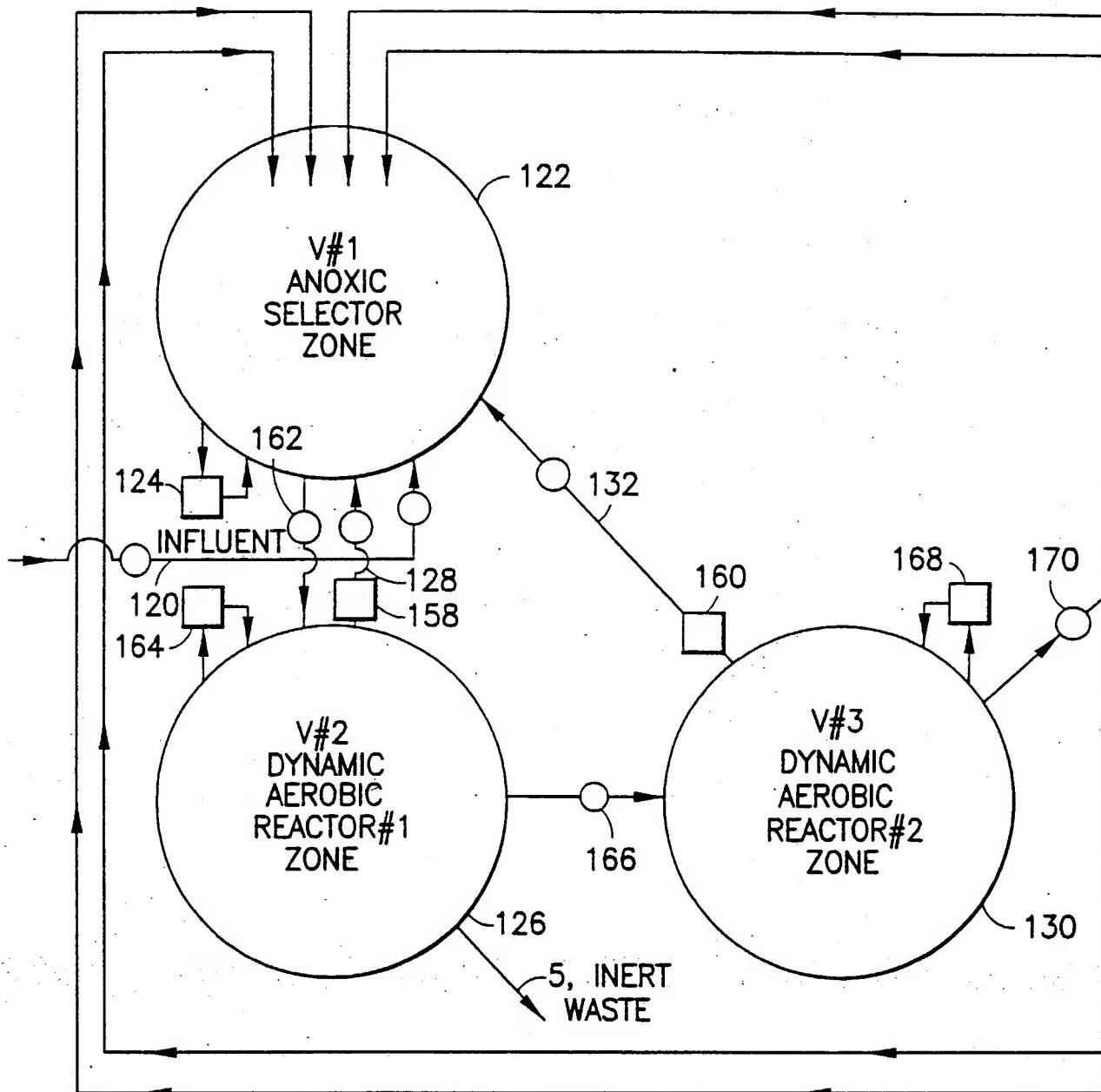


FIG.6A

FIG.6

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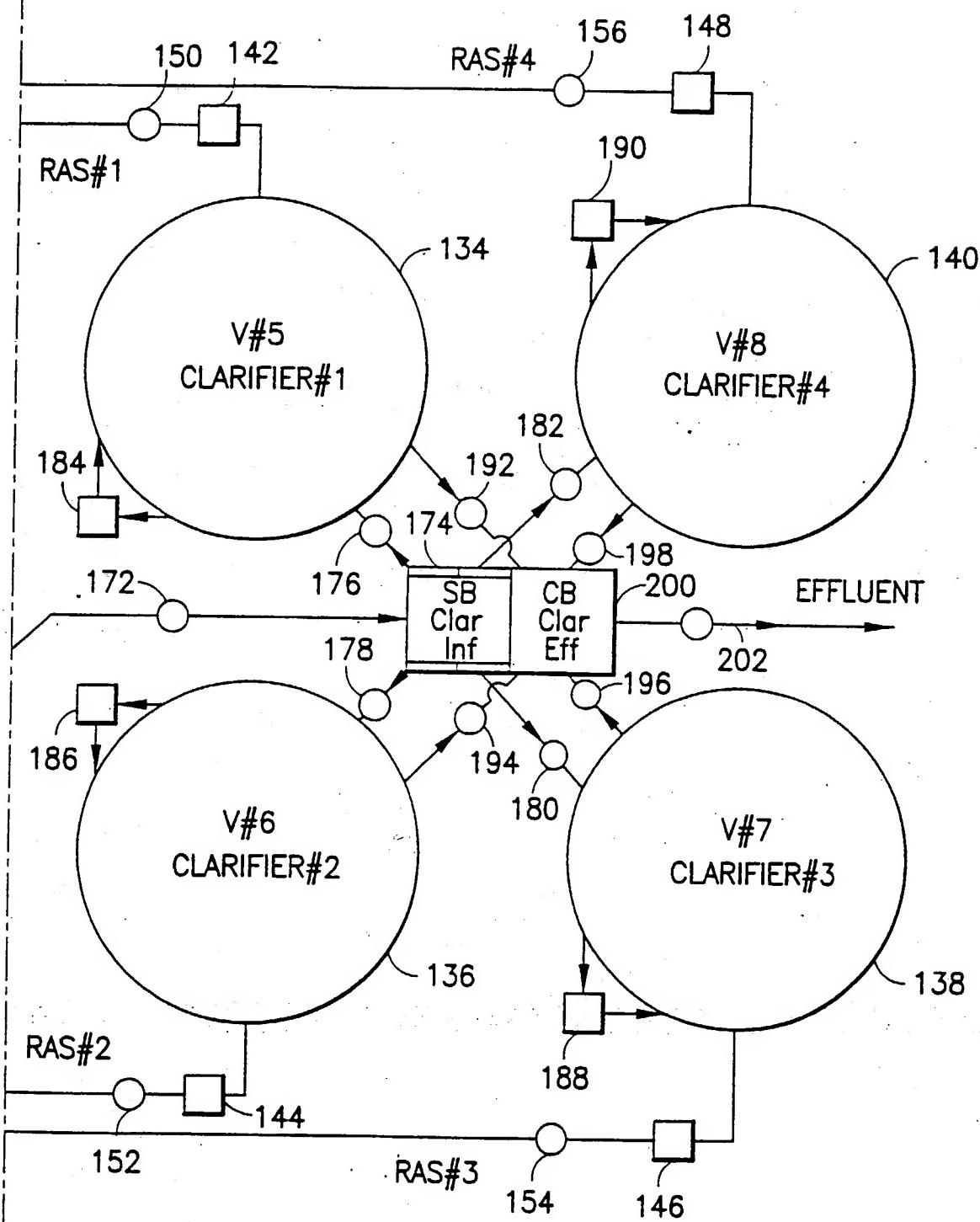


FIG. 6B

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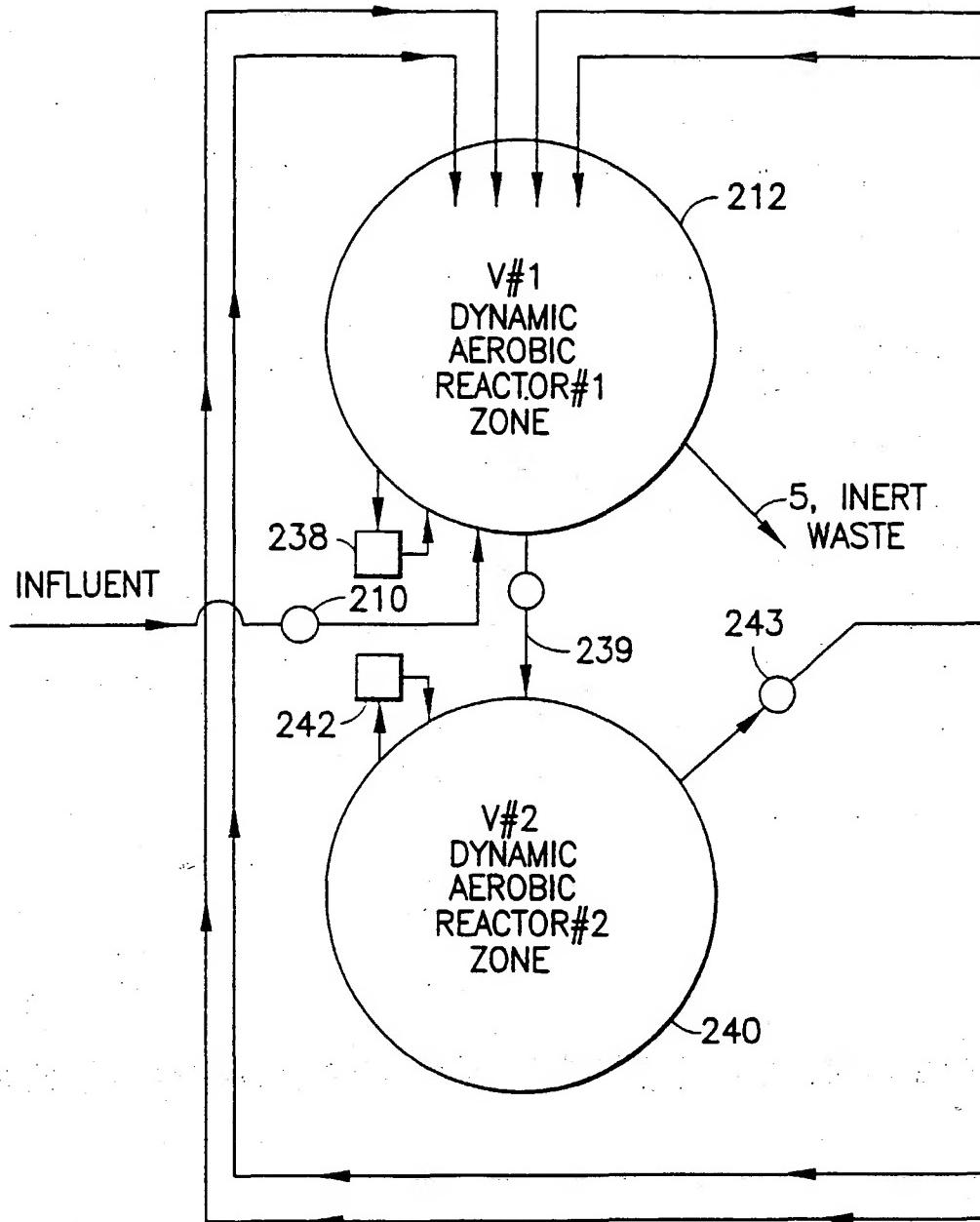


FIG.7A FIG.7B

FIG.7

FIG.7A

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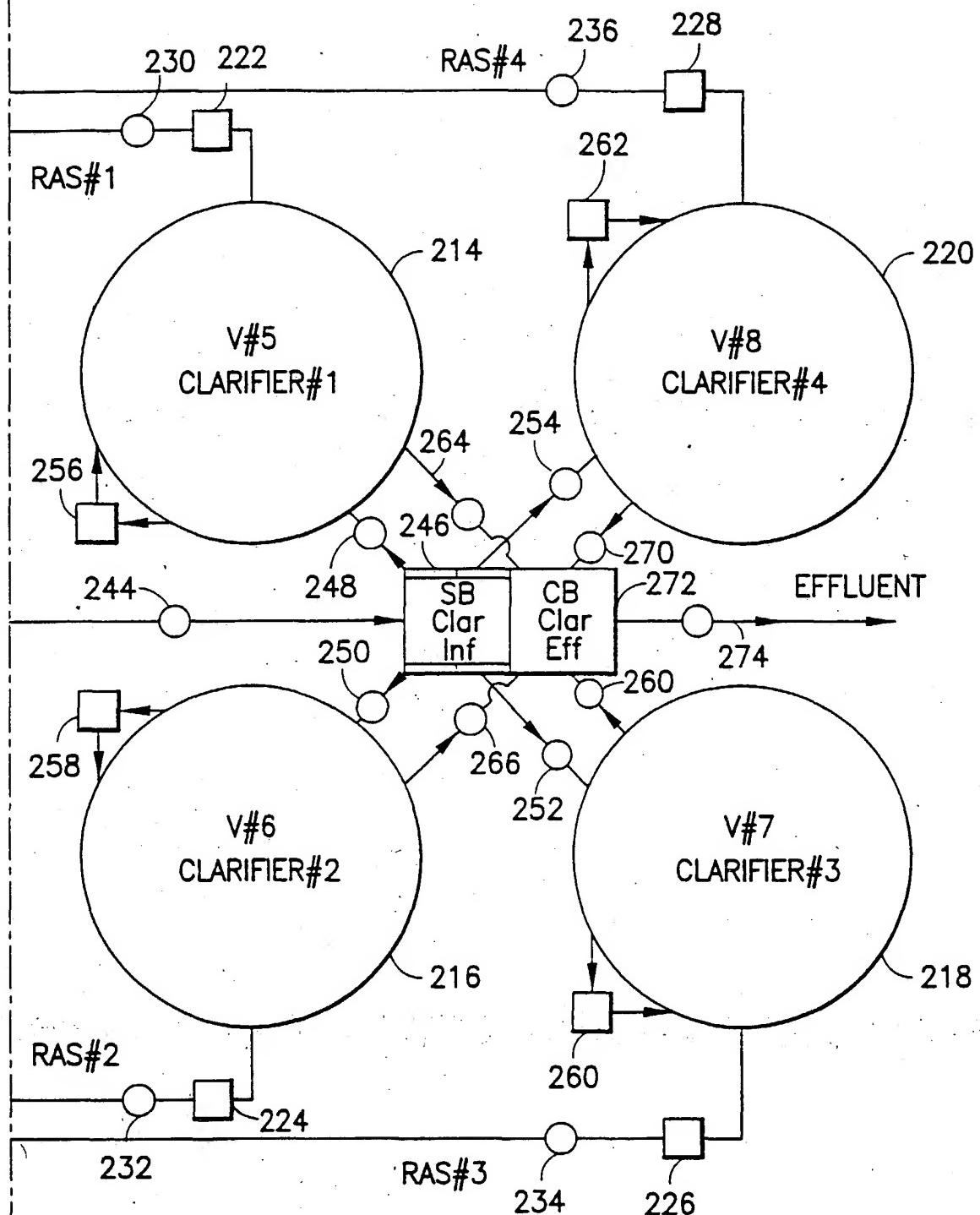


FIG.7B

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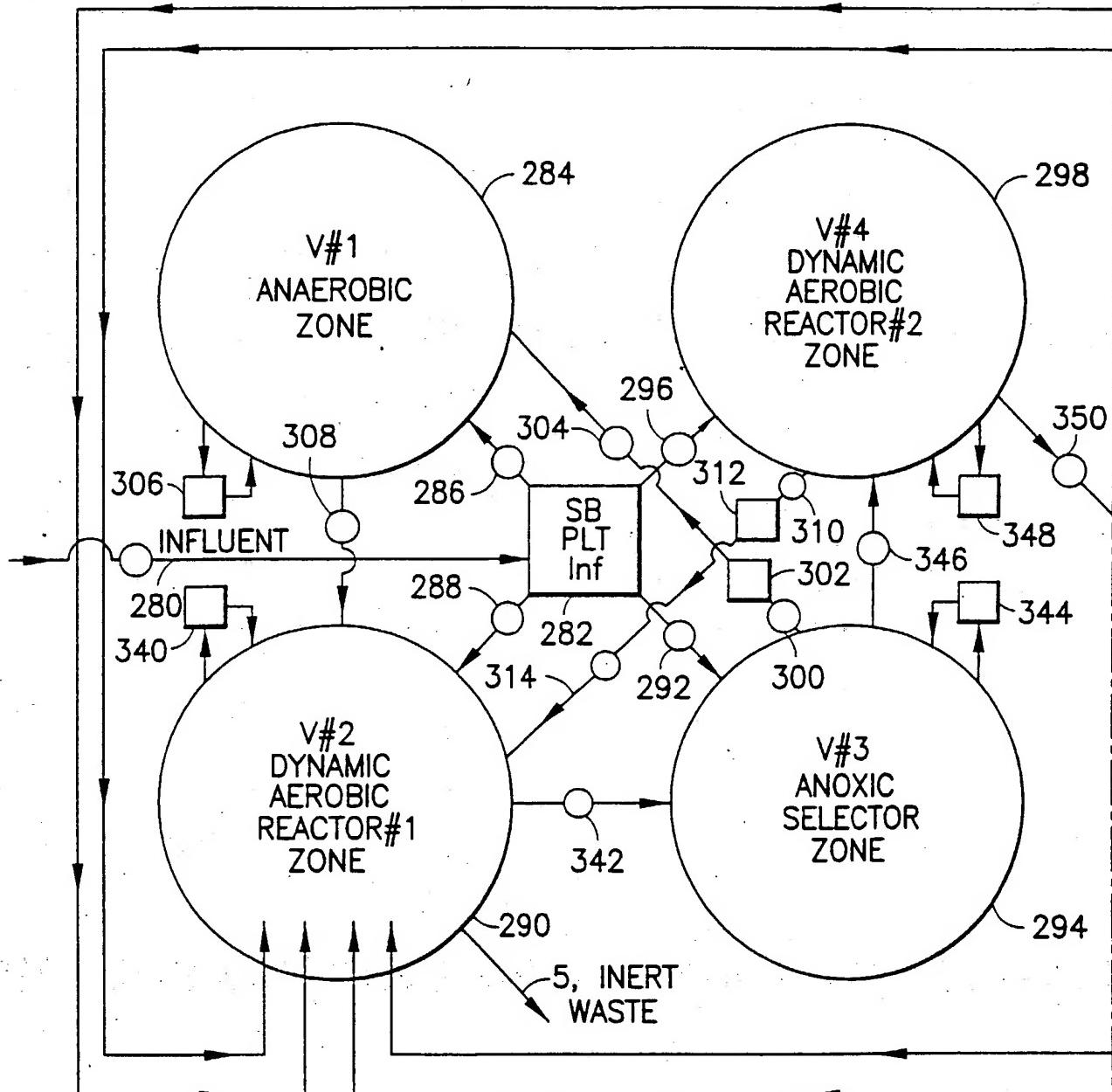


FIG.8A FIG.8B

FIG.8A

FIG.8

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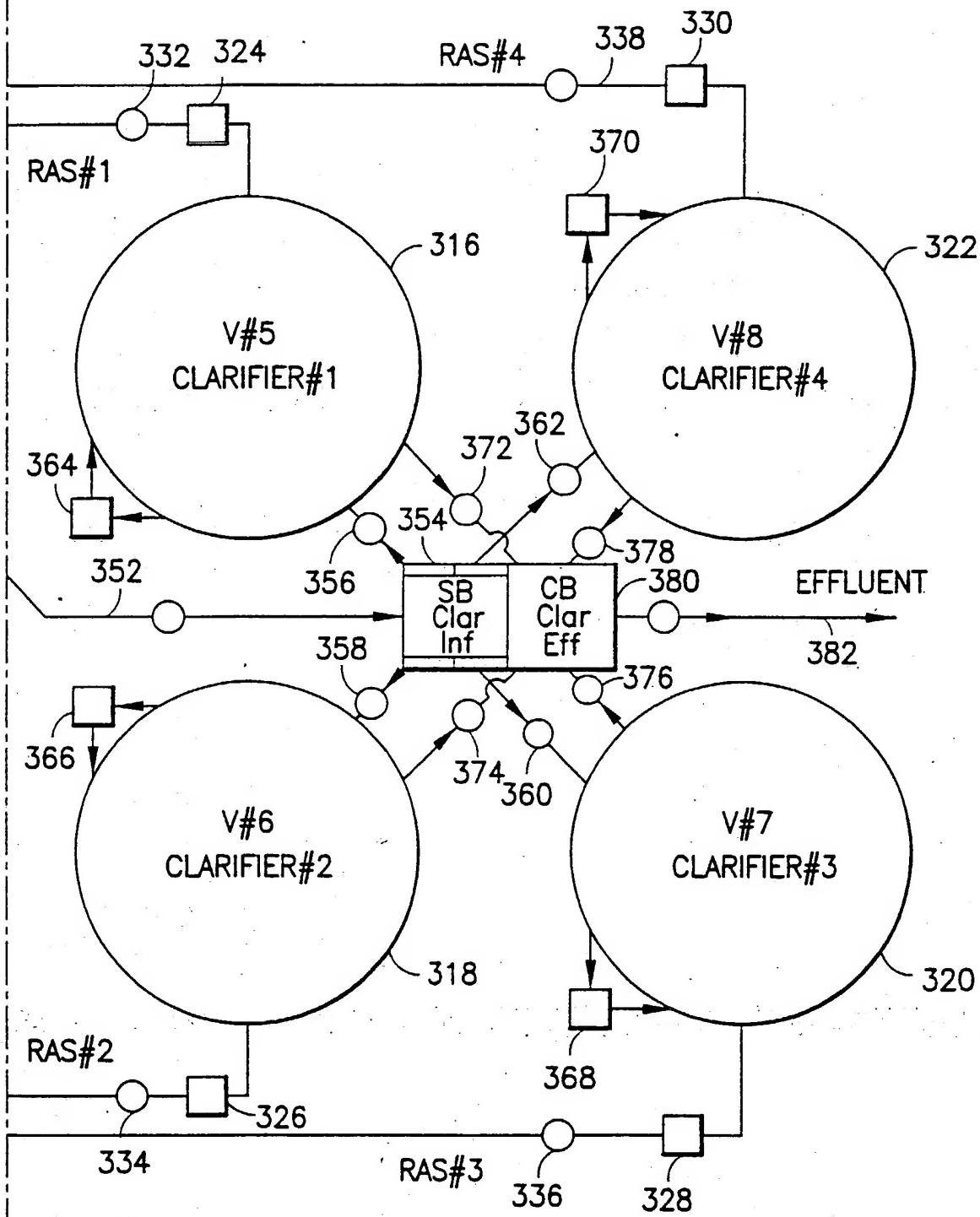


FIG.8B

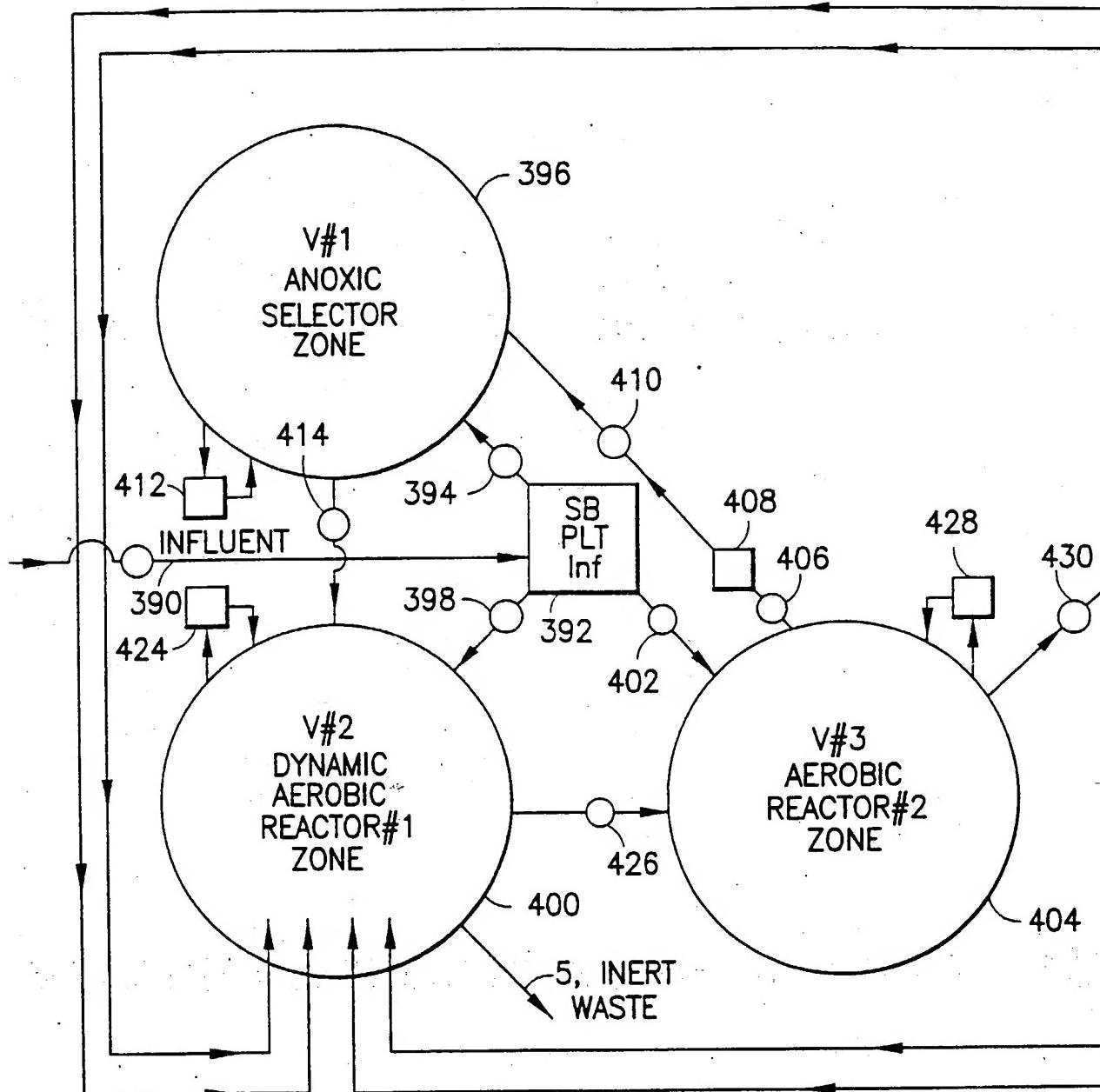


FIG.9A	FIG.9B
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FIG.9

FIG.9A

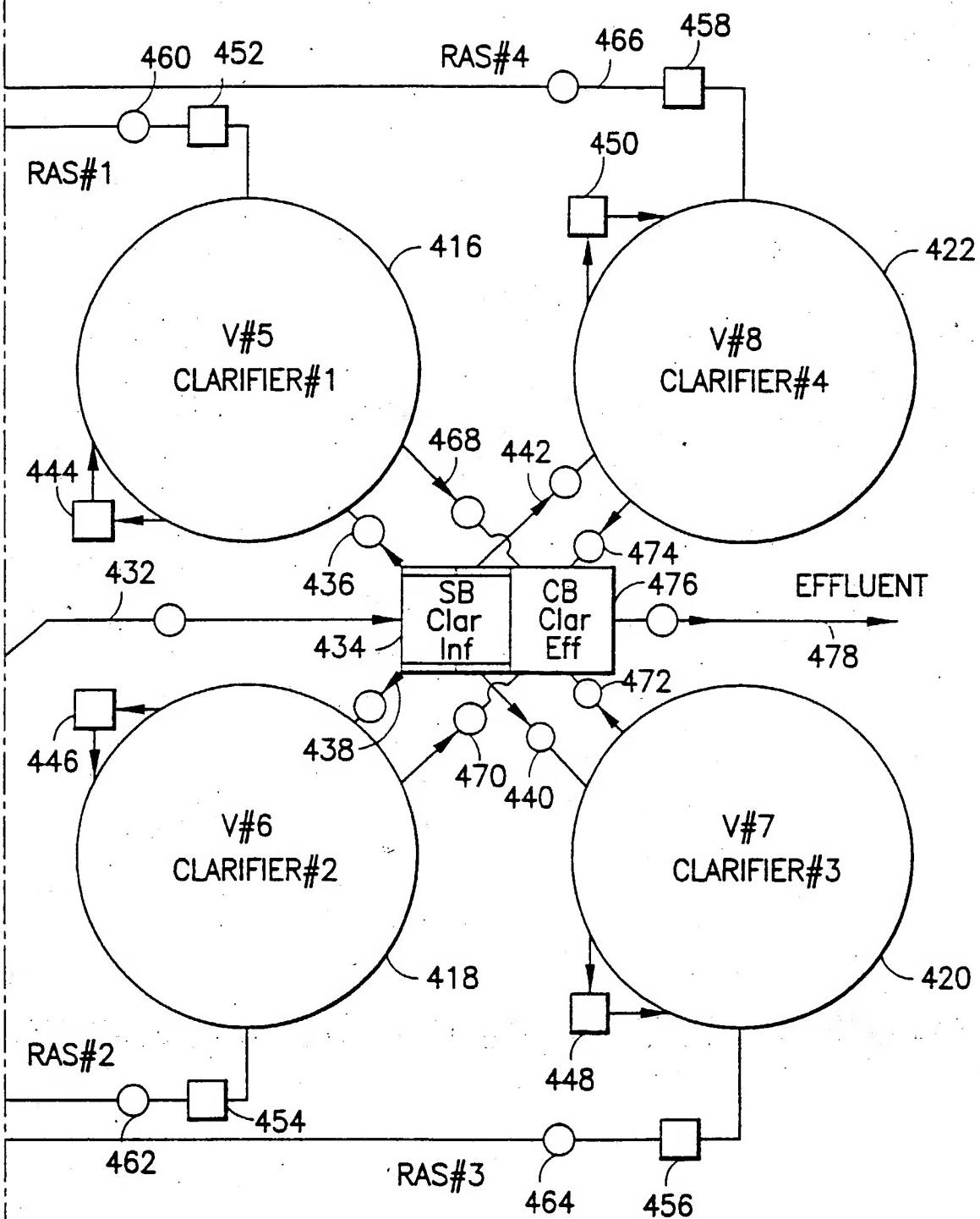


FIG. 9B

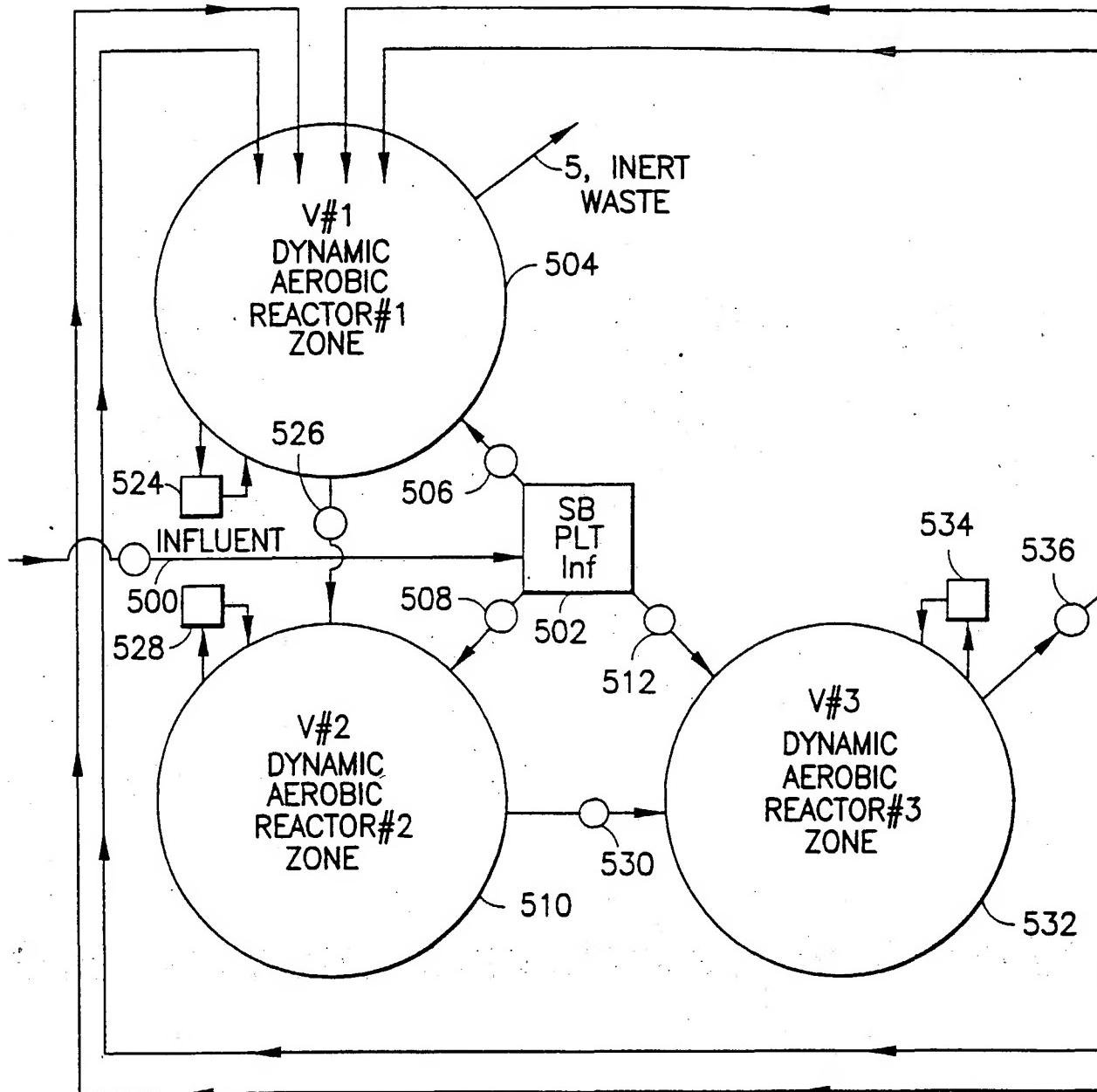


FIG.10A FIG.10B

FIG.10A

FIG.10

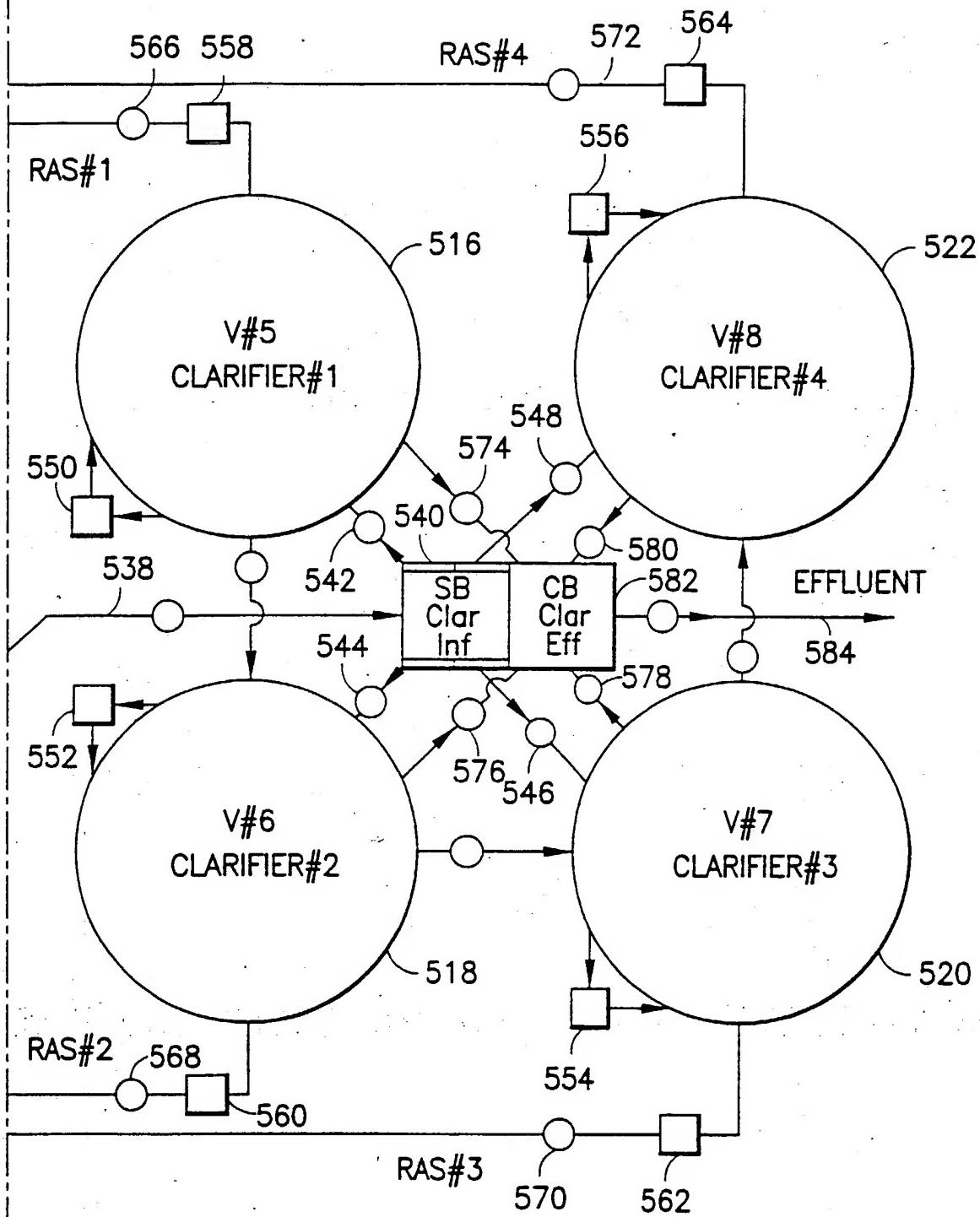
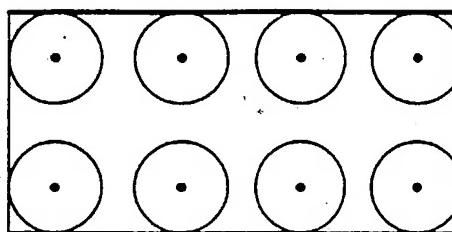
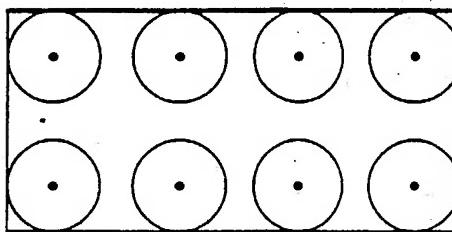


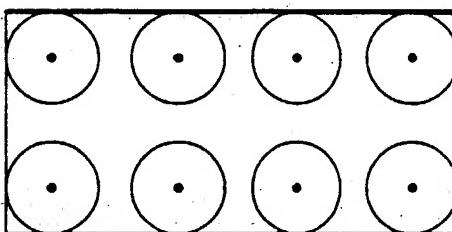
FIG.10B



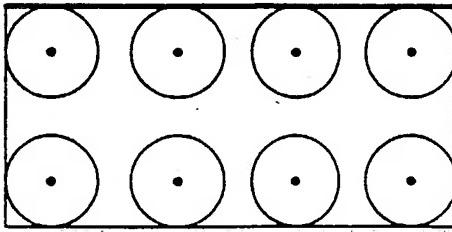
ZONE 4



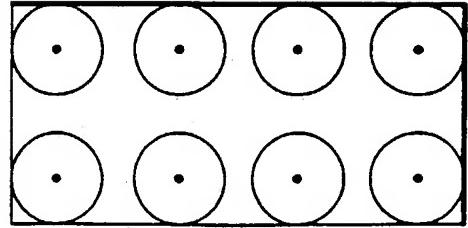
ZONE 3



ZONE 2



ZONE 1



ZONE 5

FIG. 11

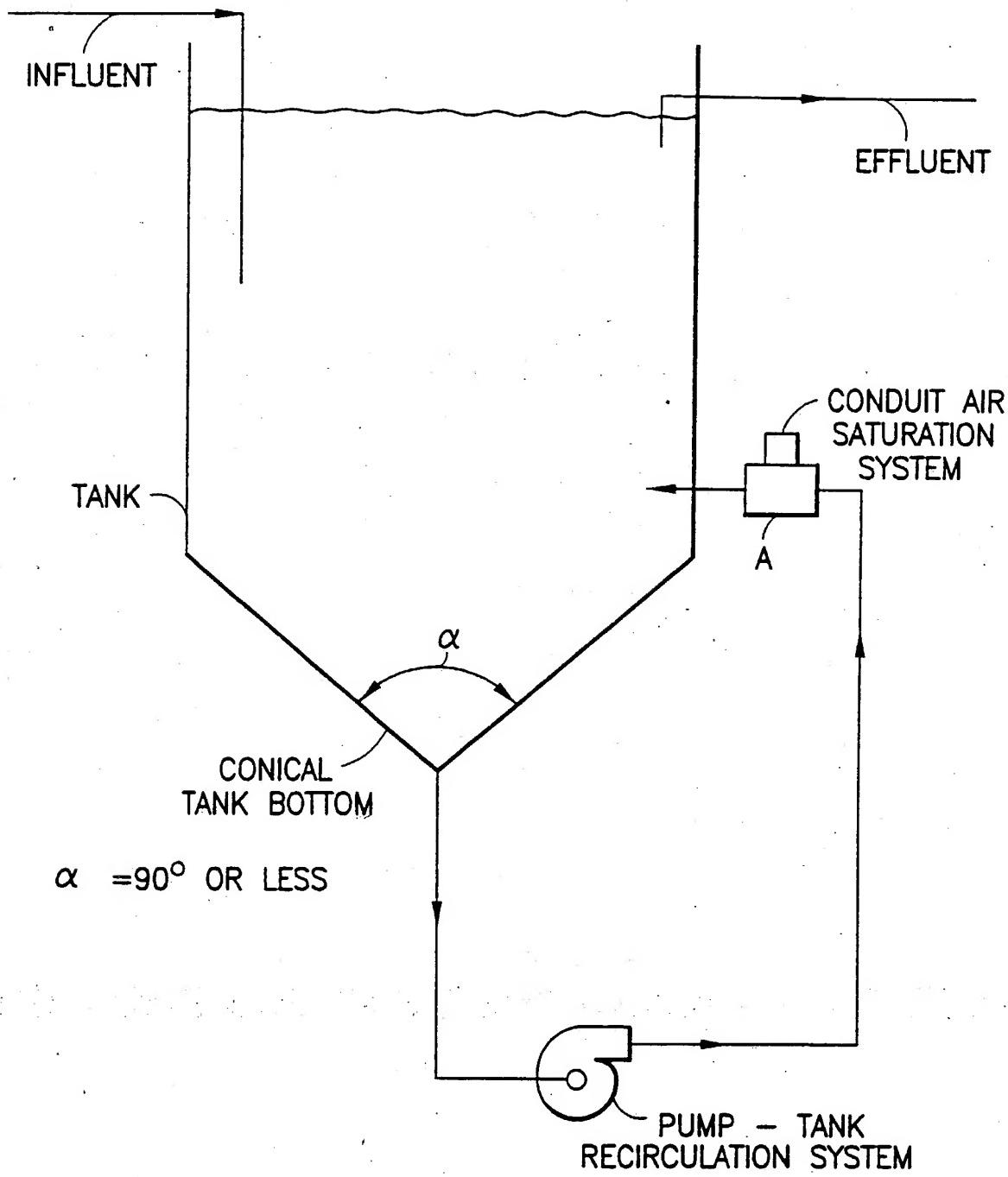


FIG.12

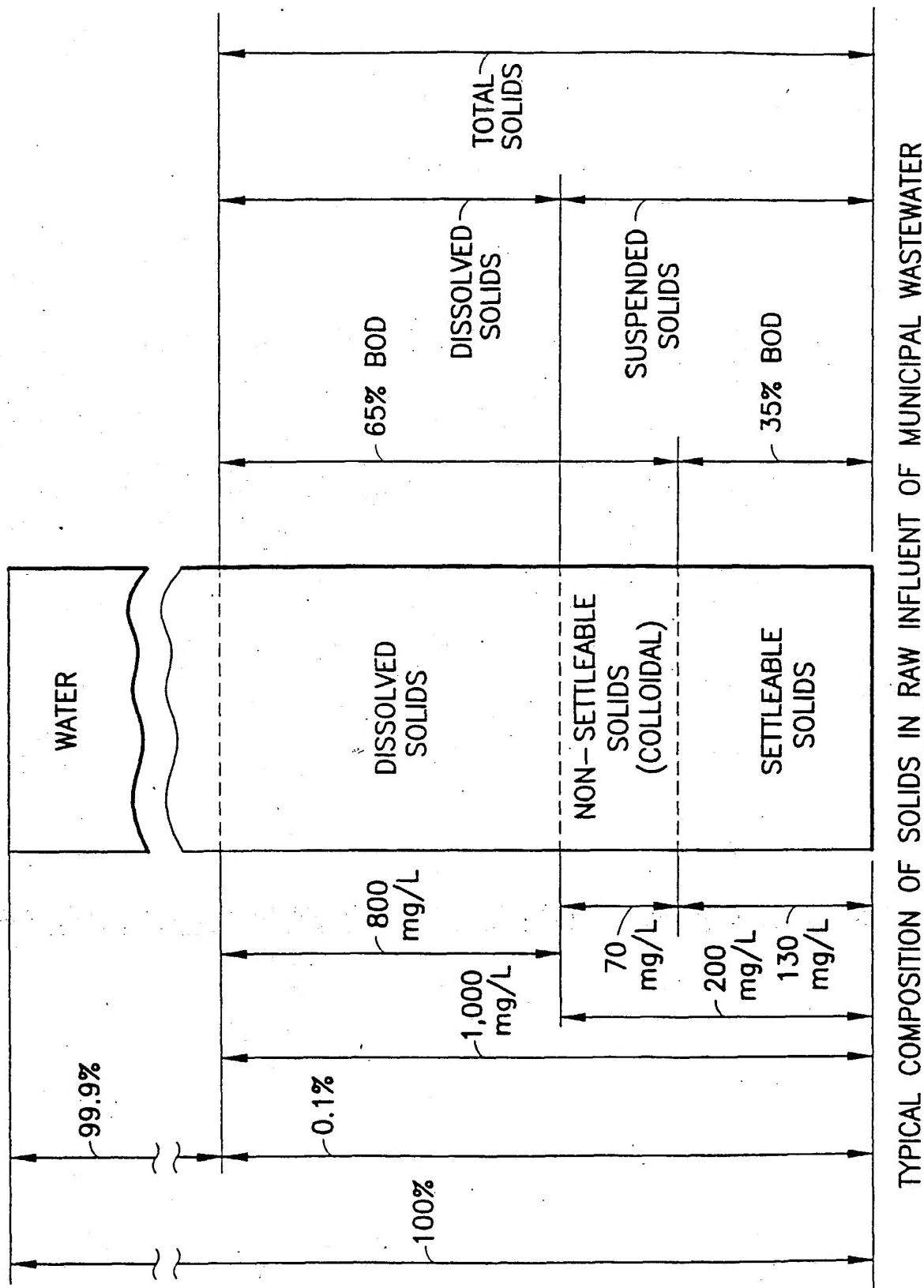


FIG. 13

TYPICAL COMPOSITION OF SOLIDS IN RAW INFLUENT OF MUNICIPAL WASTEWATER

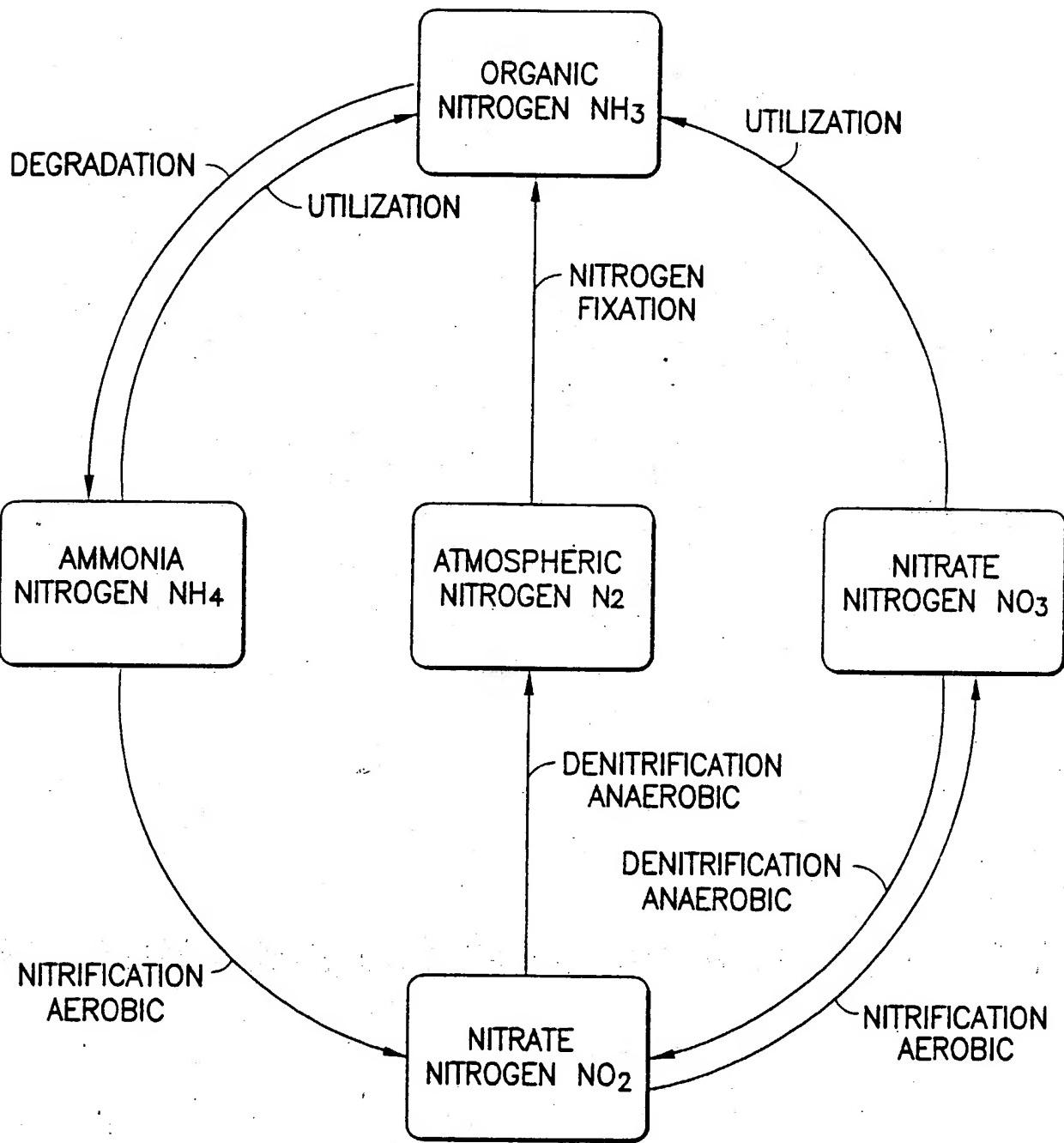
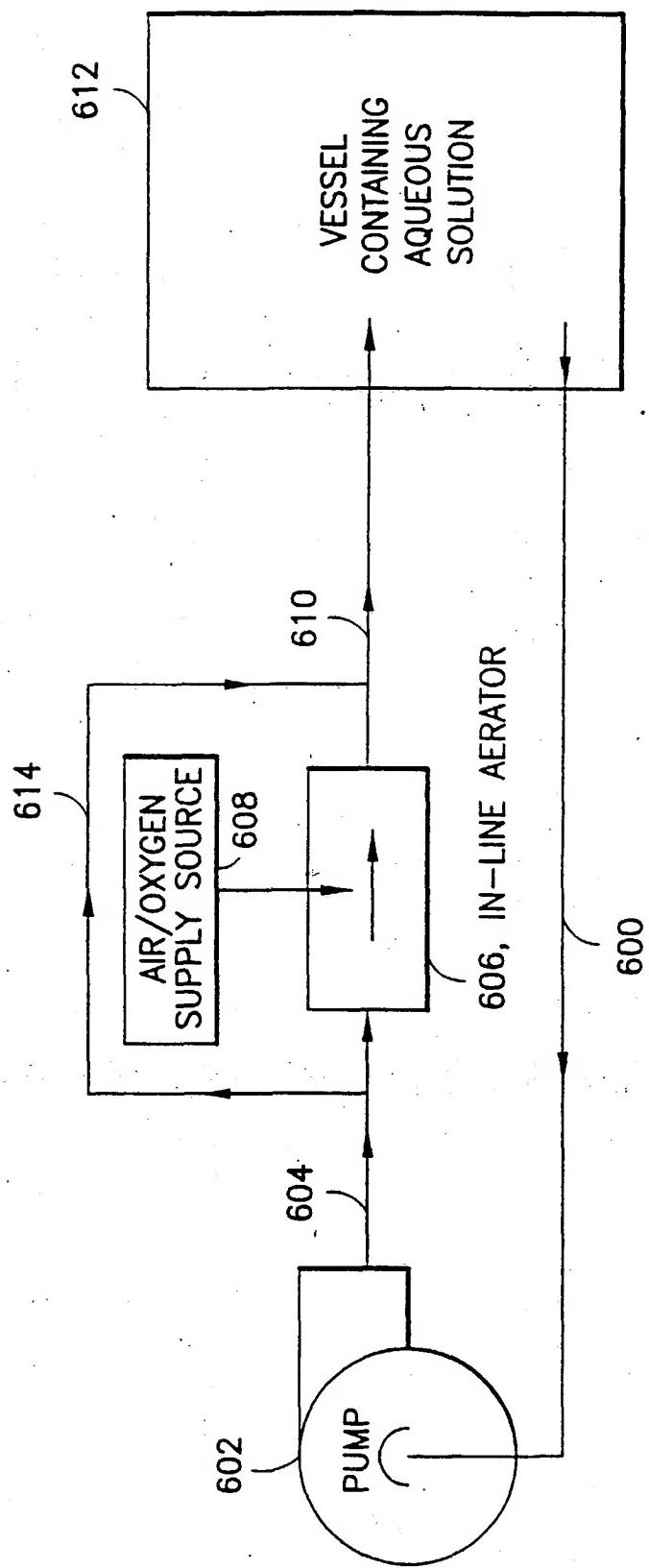
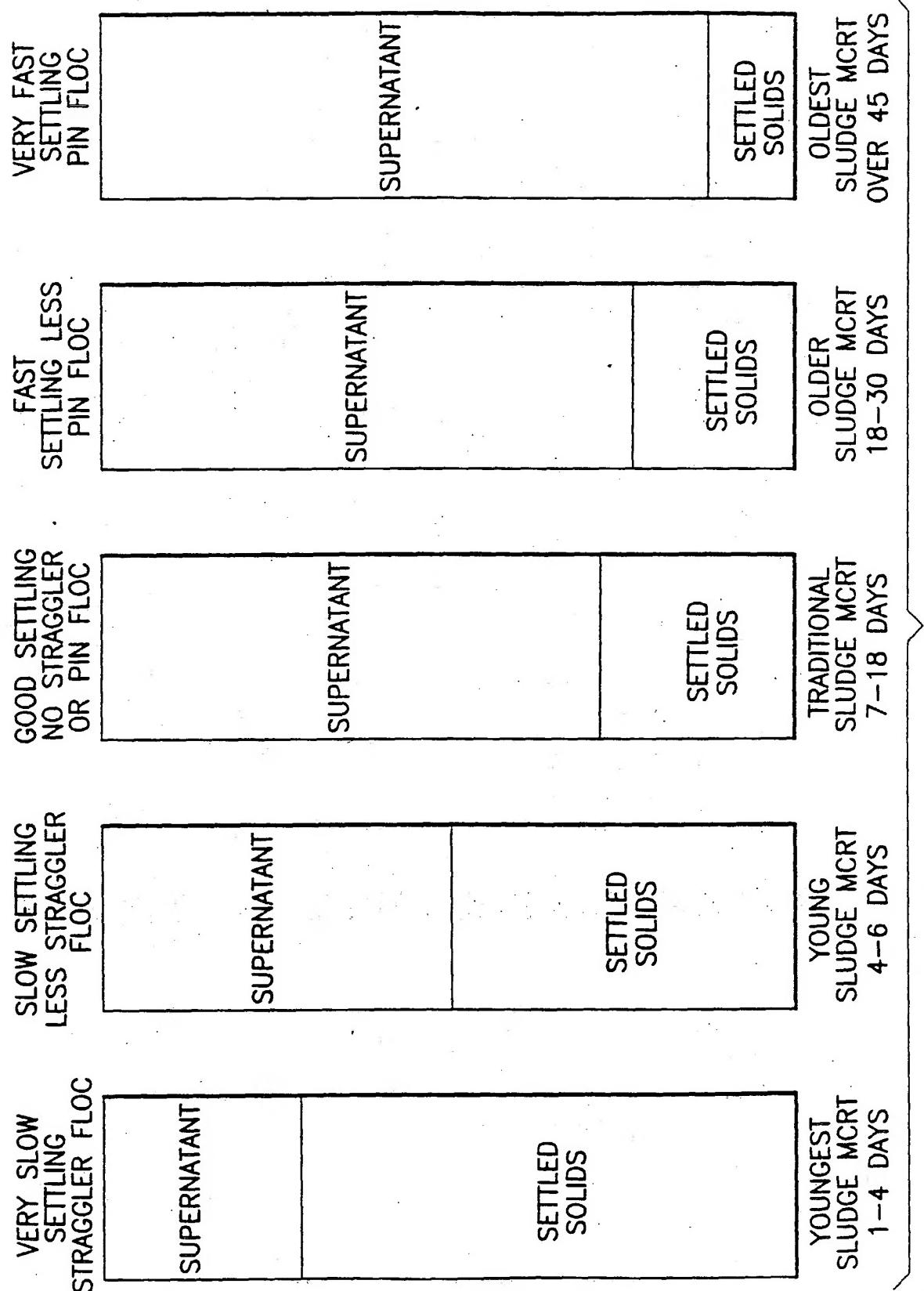
WASTEWATER NITROGEN CYCLE

FIG.14



RE-CIRCULATION AERATION SYSTEM (RCAS)  
(WITH OPTIONAL AERATOR BY-PASS)

**FIG. 15**



**FIG. 16** 30 MINUTE SOLIDS SETTLING AS RELATED TO MCRT

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### DECAY COEFFICIENT

MCRT IS MEAN CELL RESIDENCE TIME

Y IS THE YIELD COEFFICIENT

F/M IS THE FOOD TO MICROORGANISM RATIO

BOD REM EFFCY IS THE BOD REMOVAL EFFICIENCY

K<sub>d</sub> IS THE DECAY COEFFICIENT

SOLVING FOR K<sub>d</sub>

$$K_d = (Y)(F/M)(BOD \text{ REM EFFCY}) - \frac{1}{MCRT}$$

WHERE:

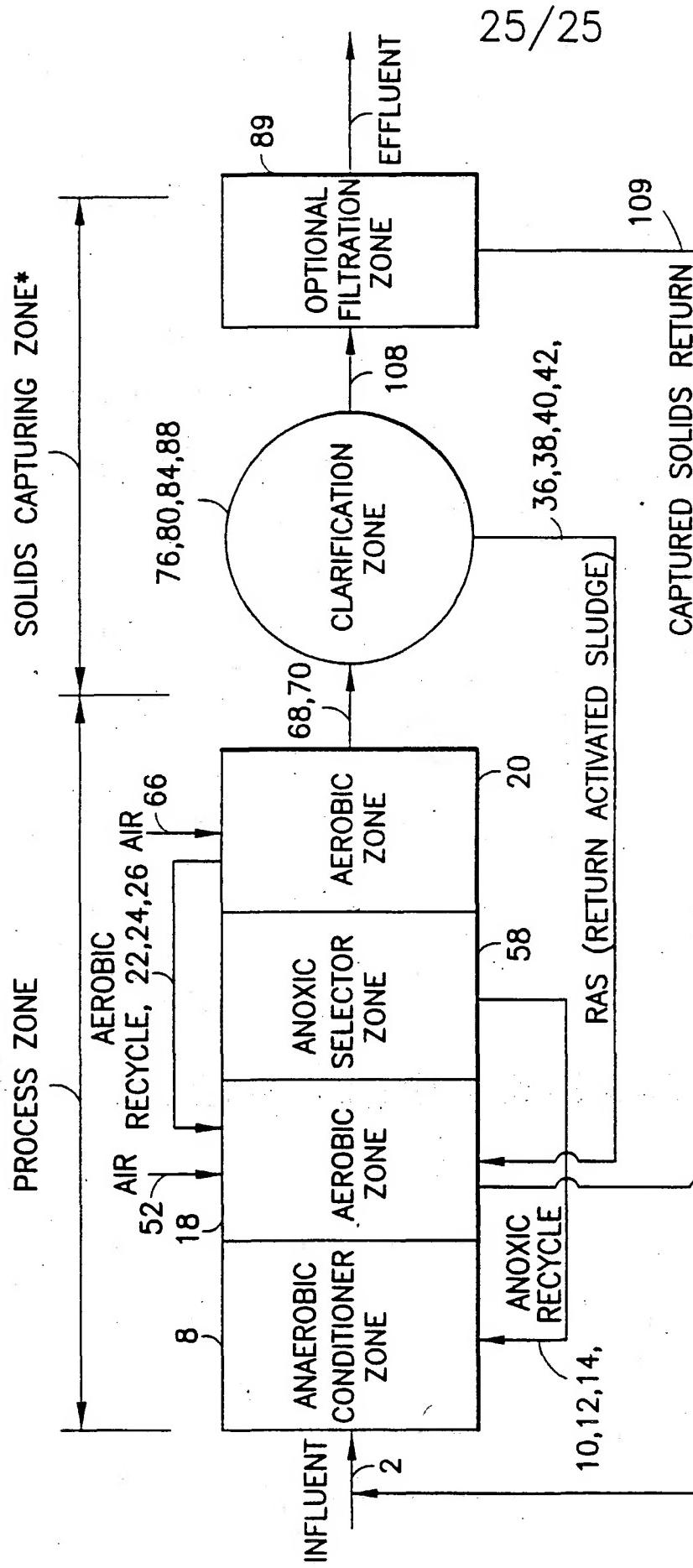
Y = 0.55 lbs OF VSS PRODUCED PER lb BOD REMOVED

F/M = lbs OF BOD APPLIED PER DAY  
lbs OF VSS IN INVENTORY

BOD REM EFFCY = % BOD REMOVED IN THE PROCESS AS A DECIMAL

MCRT = lbs MLVSS IN AERATION SYSTEM  
lbs MLVSS LEAVING AERATION SYSTEM

FIG.17



WASTE ACTIVATED SLUDGE  
CONTAINING CONCENTRATED  
INERT MATTER (INERT WASTE)

- \* SOLIDS CAPTURING ZONE IS DEFINED AS ANY TREATMENT ZONE AFTER THE PROCESSING ZONE WHICH ACTS AS A SOLIDS CAPTURING ZONE WHICH INCLUDES BUT ES NOT LIMITED TO CLARIFICATIONS AND FILTRATION STRUCTURES AND OPTIONAL TERTIARY TREATMENT SYSTEMS THAT FURTHER CAPTURES ORGANIC MATTER AND RETURNS THAT ORGANIC MATTER TO THE SYSTEM FOR CONTINUED SOLIDS DIGESTION.

## PROCESS FOR BIOLOGICAL WASTEWATER TREATMENT THAT PROVIDES ENHANCED SOLIDS REDUCTION WITH REMOVAL OF BOD, NITROGEN, AND PHOSPHOROUS

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